15

20

25

CLAIMS

WHAT IS CLAIMED IS:

- 1. A method for manufacturing an optical article comprising the steps of:
 - a) providing a substrate tube;
- b) forming one or more cladding layers inside the substrate tube, the one or more cladding layers including an innermost cladding layer;
 - c) forming a concentric fluorine reservoir adjacent to the innermost cladding layer; and
 - d) forming a core adjacent to the fluorine reservoir and concentric with the one or more outer cladding layers;
 - e) wherein the fluorine concentration in the fluorine reservoir is higher than the fluorine concentration in either the core or the innermost cladding layer.
 - 2. The method of claim 1, wherein the fluorine concentration in the fluorine reservoir is at least 30% higher than the fluorine concentration in either the core or the innermost cladding layer.
 - 3. The method of claim 1, wherein the fluorine concentration in the fluorine reservoir is at least 50% higher than the fluorine concentration in either the core or the innermost cladding layer.
 - 4. The method of claim 1 wherein the fluorine concentration in the fluorine reservoir is at least 100% higher than the fluorine concentration in either the core or the innermost cladding layer.
 - 5. The method of claim 1, wherein the steps of forming include the step of applying one or more of the following methods MCVD, sol-gel doping, coating, PCVD
 - 6. The method of claim 1, further comprising the step of placing a diffusion barrier layer in the cladding layer.
 - 7. The method of claim 1, further comprising the step of placing a diffusion barrier layer in the core.
 - 8. The method of claim 1, wherein the fluorine concentration in the fluorine reservoir is between 0.7 and 4.0 mol%.

15

- 9. The method of claim 1, wherein the core comprises silica and an active rare earth dopant.
- 10. The method of claim 1, wherein the core comprises a halide-doped silicate glass that comprises approximately the following in cation-plus-halide mole percent85-99 mol% SiO₂, 0.25-5 mol% Al₂O₃, 0.05-1.5 mol% La₂O₃, 0.0005-0.75 mol% Er₂O₃, 0.5-6 mol% F, 0-1 mol% Cl.
 - 11. The method of claim 1, wherein the core comprises a halide-doped silicate glass that comprises approximately the following in cation-plus-halide mole percent. 93-98 mol% SiO₂,1.5-3.5 mol% Al₂O₃, 0.25-1.0 mol% La₂O₃, 0.0005-0.075 mol% Er₂O₃, 0.5-2 mol% F, 0-0.5 mol% Cl.
 - 12. The method of claim 1, the core further comprising fluorine.
 - 13. The method of claim 1, wherein the fluorine reservoir further comprises silica and phosphorus oxide.
 - 14. The method of claim 13, wherein the reservoir comprises phosphorus oxide and fluorine in approximately equal concentrations.
 - 15. The method of claim 13, wherein the reservoir comprises a greater percentage of fluorine than phosphorus oxide.
 - 16. The method of claim 1, wherein the reservoir comprises about 95.7-99.7 mol% silica, about 0.3-4 mol% fluorine and about 0-0.4 mol% phosphorus oxide.
- The method of claim 1, wherein the innermost cladding comprises silica, fluorine and phosphorus oxide, wherein the cladding comprises at least 95 mol% silica.
 - 18. The method of claim 1, wherein the innermost cladding comprises silica, fluorine and phosphorus oxide, wherein the innermost cladding has a refractive index matched to the refractive index of the silica substrate tube.
- The method of claim 1, wherein the innermost cladding comprises silica, fluorine and phosphorus oxide, wherein the outermost cladding has a refractive index matched to the refractive index of the silica substrate tube, and the innermost cladding has a lower refractive index than either the outermost cladding or the silica substrate tube.

20

- 20. The method of claim 1, wherein the innermost cladding comprises silica, fluorine and phosphorus oxide, wherein the mol % of fluorine and phosphorus oxide present is approximately 0.8 and 0.7 mol% respectively.
- The method of claim 1, wherein the innermost cladding has a refractive index that is less than that of the substrate tube, wherein the innermost cladding comprises approximately 0.3 mol% of phosphorus oxide and at least 2.0 mol % of fluorine.
 - 22. An optical fiber manufactured in accordance with the method of claim 1.
 - 23. An optical preform manufactured in accordance with the method of claim 1.
 - 24. An optical fiber manufactured from the optical preform of claim 22.
- 10 25. A method for manufacturing an optical fiber comprising the steps of:
 - a) providing a substrate tube;
 - b) forming one or more outer cladding layers;
 - c) forming a reservoir including fluorine, the reservoir being concentric with the one or more outer cladding layers and adjacent to the innermost cladding layer;
 - d) forming a core adjacent to the reservoir and concentric with the one or more outer cladding layers;
 - e) wherein the fluorine concentration in the reservoir is higher than the fluorine concentration in either the core or the innermost cladding; and
 - f) diffusing at least a portion of the fluorine in the reservoir to form a fluorine concentration zone.
 - 26. The method of claim 24, wherein the step of diffusing the fluorine comprises achieving a desired fluorine concentration profile by heating the reservoir.
 - 27. The method of claim 25, wherein the step of heating comprises applying heat to the substrate tube and collapsing the tube into a preform.
- 25 28. The method of claim 26, further comprising the step of heat treating the substrate tube to diffuse the fluorine before the step of collapsing the tube.
 - 29. The method of claim 24, further comprising the step of collapsing the substrate tube into a preform and drawing an optical fiber from the preform, wherein the step of diffusing comprises drawing the fiber.

- 30. The method of claim 25 wherein additional heat treatments are performed to the preform to enhance fluorine diffusion
- 31. The method of claim 25 wherein additional heat treatments are performed to the fiber to enhance fluorine diffusion
- 5 32. The method of claim 24, further comprising the step of forming a diffusion barrier layer between the cladding and the fluorine reservoir.
 - 33. An optical fiber manufactured in accordance with the method of claim 24.
 - 34. An optical preform manufactured in accordance with the method of claim 24.
 - 35. A method for manufacturing an optical article comprising the steps of:
- 10 a) forming a core;
 - b) forming a fluorine reservoir concentric adjacent to the core;
 - c) forming one or more cladding layers, the one or more cladding layers including an innermost cladding layer and concentric to the core;
 - d) wherein the fluorine concentration in the fluorine reservoir is higher than the fluorine concentration in either the core or the innermost cladding layer.